CLAIMS

1. A process for producing a fuel electrode of a solid oxide fuel cell, each cell comprising a solid electrolyte layer, a fuel electrode disposed on one surface of the solid electrolyte layer, and an air electrode disposed on an opposite surface, by alternately laminating a plurality of cells, adjacent cells being electrically connected to each other, and a plurality of separators for distributing fuel gas to the fuel electrode of each cell and oxidizing gas to the air electrode, comprising the steps of: adding a solution of a metallo-organic compound of yttrium (Y) and a solution of a metallo-organic transition-metal compound to a solution of a metallo-organic compound of zirconium (Zr) to prepare a mixed solution of metallo-organic compounds of Zr-Y-transition metal; mixing NiO powder to the mixed solution of the metallo-organic compounds to prepare a slurry; and successively subjecting the slurry to hydrolysis, polycondensation, pyrolysis, annealing and reduction to obtain a cermet comprising yttria-stabilized zirconia (YSZ) containing said transition metal dissolved therein and having electronic conductivity in a fuel electrode operating atmosphere and nickel (Ni).

2. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein said transition metal is cerium (Ce).

3. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein said transition metal is titanium (Ti) or praseodymium (Pr).

4. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein said metallo-organic compound is a metallic aliphatic acid salt.

5. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein said metallo-organic compound is a metallic acetyl acetonate complex.

6. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 4 wherein said metallic aliphatic acid salt is a metallic octylate.

7. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein said fuel electrode is formed on a solid electrolyte by a screen printing process.

8. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein a concentration of Ni in said cermet is in the range of 20% to 95% at a volume fraction.

9. The process for producing the fuel electrode of

the solid oxide fuel cell according to claim 1 wherein a concentration of the transition metal in YSZ containing said transition metal dissolved therein is in the range of 1 mol% to 30 mol%.

10. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein a concentration of YSZ containing the transition metal dissolved therein in said cermet is in the range of 1% to 50% at a volume fraction.

11. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 1 wherein said hydrolysis is performed using moisture in air.

12. A process for producing a fuel electrode of a solid oxide fuel cell, each cell comprising a solid electrolyte layer, a fuel electrode disposed on one surface of the solid electrolyte layer, and an air electrode disposed on an opposite surface, by alternately laminating a plurality of cells, adjacent cells being electrically connected to each other, and a plurality of separators for distributing fuel gas to the fuel electrode of each cell and oxidizing gas to the air electrode, comprising the steps of: adding a solution of a metallo-organic compound of yttrium (Y) and a solution of a metallo-organic transition-metal compound to a solution of a metallo-organic compound of zirconium (Zr) to prepare a mixed solution of metallo-organic compounds of Zr-Y-

transition metal; mixing NiO powder and cerium oxide powder containing a divalent or trivalent metal oxide dissolved therein to the mixed solution of the metallo-organic compounds to prepare a slurry; and successively subjecting the slurry to hydrolysis, polycondensation, pyrolysis, annealing and reduction to obtain a cermet comprising yttria-stabilized zirconia (YSZ) containing a transition metal dissolved therein, nickel (Ni) and cerium oxide containing a divalent or trivalent metal dissolved therein.

13. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said transition metal is cerium (Ce).

14. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said transition metal is titanium (Ti) or praseodymium (Pr).

15. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said metallo-organic compound is a metallic aliphatic acid salt.

16. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said metallo-organic compound is a metallic acetyl acetonate complex.

17. The process for producing the fuel electrode of

the solid oxide fuel cell according to claim 15 wherein said metallic aliphatic acid salt is a metallic octylate.

18. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said fuel electrode is formed on a solid electrolyte by a screen printing process.

19. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein a volume fraction of the cerium oxide containing the divalent or trivalent metal dissolved therein in said cermet is in the range of 1% to 70%.

20. ~~The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein a concentration of Ni in said cermet is in the range of 20% to 95% at a volume fraction.~~

21. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein a concentration of the transition metal in YSZ containing said transition metal dissolved therein is in the range of 1 mol% to 30 mol%.

22. ~~The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein a concentration of YSZ containing the transition metal~~

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dissolved therein in said cermet is in the range of 1% to 50% at a volume fraction.

23. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said divalent or trivalent metal oxide is one or a combination of plural ones selected from the group consisting of BeO, MgO, CaO, SrO, BaO, Sm_2O_3, Y_2O_3, La_2O_3, Gd_2O_3, Sc_2O_3, Pr_2O_3, Nd_2O_3, Eu_2O_3, Yb_2O_3, Dy_2O_3, and Ho_2O_3.

24. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said cermet has a structure in which surfaces of Ni particles and surfaces of cerium oxide particles containing the divalent or trivalent metal dissolved therein are covered with YSZ containing said transition metal dissolved therein in a form of thin films or fine particles.

25. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein said hydrolysis is performed using moisture in air.

26. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 12 wherein as materials of said cermet, cerium oxide powder containing the divalent or trivalent metal dissolved therein, Ni powder and a metallic octylate solution of Ce, Y and Zr are used, and YSZ fine particles containing the transition metal dissolved

therein are uniformly dispersed between the cerium oxide particles containing the divalent or trivalent metal dissolved therein and the Ni particles.

27. The process for producing the fuel electrode of the solid oxide fuel cell according to claim 26 wherein an average particle diameter of said Ni particles is 1 μm or more, the average particle diameter of said cerium oxide particles containing the divalent or trivalent metal dissolved therein is 1 μm or more, and the average particle diameter of said YSZ particles containing the transition metal dissolved therein is 1 μm or less.

28. A fuel electrode of a solid oxide fuel cell comprising a cermet of yttria-stabilized zirconia (YSZ) containing a transition metal dissolved therein and having electronic conductivity in a fuel electrode operating atmosphere and nickel (Ni).

29. The fuel electrode of the solid oxide fuel cell according to claim 28 wherein said cermet has a structure in which Ni particles and YSZ particles containing the transition metal dissolved therein are uniformly dispersed.

30. A fuel electrode of a solid oxide fuel cell comprising a cermet of yttria-stabilized zirconia (YSZ) containing a transition metal dissolved therein and having electronic conductivity in a fuel electrode operating

atmosphere, nickel (Ni), and cerium oxide containing a divalent or trivalent metal dissolved therein.

31. The fuel electrode of the solid oxide fuel cell according to claim 30 wherein said cermet has a structure in which surfaces of Ni particles and surfaces of cerium oxide particles containing the divalent or trivalent metal dissolved therein, uniformly dispersed in the cermet, are covered with YSZ thin films or fine particles containing the transition metal dissolved therein.

32. The fuel electrode of the solid oxide fuel cell according to claim 30 wherein as materials of said cermet, cerium oxide powder containing a divalent or trivalent metal dissolved therein, Ni powder and a metallic octylate solution of Ce, Y and Zr are used, and YSZ fine particles containing the transition metal dissolved therein are uniformly dispersed between the cerium oxide particles containing the divalent or trivalent metal dissolved therein and the Ni particles.

33. The fuel electrode of the solid oxide fuel cell according to claim 32 wherein an average particle diameter of said Ni particles is 1 µm or more, the average particle diameter of said cerium oxide particles containing the divalent or trivalent metal dissolved therein is 1 µm or more, and the average particle diameter of said YSZ particles containing the transition metal dissolved therein is 1 µm or

less.